Design Project Specifications

The basic task has been described as follows:

Construct an autonomous, one-on-one soccer-playing robot capable of operating in either an offensive or defensive position with a 12' x 12' enclosure as shown below in Figure 1. At the start of the competition, each robot receives a message over WiFi indicating whether it plays offense or defense, and the parameters of the field (that are changed at the start of each round).
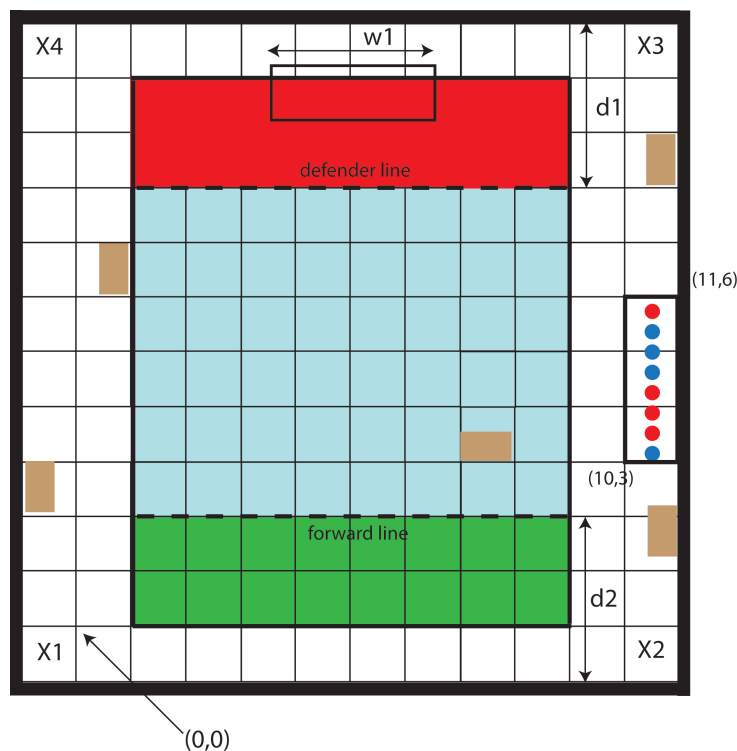

Figure 1

The coordinate system starts in the lower left hand corner marked (0,0) and increases horizontally along the X-axis ($X_{max} = 11$), and vertically along the Y-axis ($Y_{max} = 11$). Your robot will be placed in one of the 4 corners marked X1-X4 respectively at an arbitrary orientation. Once the robots are in starting position, you will be instructed to start your code in the usual manner by pressing the Enter button on the EV3 console, after which you may no longer physically or electronically contact your robot. At this point your robot will establish a connection to the competition server using the `WiFiConnection` class (that will be provided to you). Note that your robot is not allowed to move until it retrieves the parameters for the current run using the `getTransmission` method. The parameters are as follows:

Parameter	Description	Values	Units
SC	Starting corner – tells the robot into which corner it has been placed.	[1,4]	integer
Role	Indicates position played by robot.	0 (forward) 1 (defense)	integer integer
w1	Width of the goal. Goal is always placed at center as shown.	[1,4]	tiles
d1	Position of defender line.	[1,5]	tiles
d2	Position of forward line.	[1,5]	tiles
ll-x	X-coordinate of lower left hand corner of ball set.	[-1,11]	tiles
ll-y	Y-coordinate of the above.	[-1,11]	tiles
ur-x	X-coordinate of upper right hand corner of ball set.	[-1,11]	tiles
ur-y	Y-coordinate of the above.	[-1,11]	tiles
BC	Forward ball color.	0 (red) 1 (blue)	integer integer
n.b. [-1,5] = {-1,0,1,2,3,4,5}		2 (any)	integer

Example:

Assume that a robot is placed in position X1 for the field configuration shown in Figure 1, assigned the role of forward, and instructed to use blue balls only. It will receive the following set of parameters (1,0,3,3,3,10,3,11,6,1).

Upon receipt of the parameters, each player navigates to its respective field zone (red or green areas), without crossing the neutral zone (blue). Once the defender reaches its zone, it remains there for the rest of the competition, blocking shots on net. Once the forward reaches its zone, it is allowed to proceed to the ball storage area to retrieve balls for play. The only restriction on the forward is that it must **not** enter the defender zone Game play proceeds until time (5 minutes) runs out.

Scoring is on a points-based system, with 1 point each awarded for demonstrating the following capabilities:

Localization	Must be completed in less than 30 seconds.
Navigation to zone	While staying outside of the blue and opponent zones.
Collision avoidance	Does not hit any obstacles on the way.
Navigation to balls	While staying out of opponent zone.
Correct color identification	While retrieving a ball.
Bringing ball back to field	While maintaining control.
Goals scored	2 points for each goal.
Shots blocked	1 point for each.

The competition will consist of 2 rounds. In each round, each player will get the opportunity to play both as forward and defender (for a total of 4 runs).

Details

1. The dimensions and layout of the field are shown in Figure 1. To facilitate operations, the floor is comprised of nine 4'x 4' hardwood-covered metal panels that lock together. The surface of each panel is marked with a 4'x4' grid that aligns precisely with adjacent panels. These are intended for navigational purposes, which were covered during one of the one-week labs.
2. Obstacles will consist of wooden blocks (the kind found in the lab) and can be placed anywhere (as shown), except for the red and green player zones. Figure 1 shows that obstacles can be placed in the neutral (blue) zone. However these will be limited to a single block, requiring a downrange scan by the forward to see if the path is clear.
3. Once both players arrive at their starting positions, only the forward will be permitted to use its ultrasonic sensor.
4. At the start of each round, both teams will be directed to place their robots in one of the 4 corners shown, at a random position and orientation within the corresponding tiles. When executing its localization routine, your robot must always keep the center of rotation within the tile (this implicitly limits the footprint of your robot). Localization must be completed in 30 seconds or less.
5. You will be provided with a Wifi class as described above.
6. For the purposes of the course, a successful design is one that can successfully score on an opponent at least once.
7. For the competition (which has nothing to do with your final grade), the 3 teams with the most points will be awarded prizes and bragging rights.
8. You may use up to 3 Mindstorms kits to fabricate your design. Any other material used must be with the explicit permission of the instructors. Further, any such materials will be posted to an "additional bill of materials" list on myCoursesII which may then be used by other groups.

As further information becomes available, this list will be expanded accordingly.

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